

# Petroleum Products Prices and Inflationary Dynamics in Nigeria.

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**Abstract**

*It is well documented in the literature that there exists a positive relationship between oil price and inflation. In this study, we found that the price of Premium Motor Spirit (PMS) remained stable until the entry of the military into the administration of the country when the then military heads of state arbitrarily increased the prices of petroleum products. We also found that there exists high positive relationship between the prices of PMS and AGO and inflation in Nigeria. We therefore conclude that rises in petroleum products prices, especially PMS and AGO, significantly impact inflation in Nigeria. With this result, we recommend that government should shelve the idea of removing subsidy on PMS for now and should focus on deregulating the downstream sector to attract private investment with the aim of encouraging local refining of petroleum products instead of importing them. This will in turn reduce domestic prices for petroleum products and consequently inflation.*

**Keywords**: Premium Motor Spirit, Automotive Gas Oil, Dual Purpose Kerosene, Inflation.

**JEL CLASSIFICATION:** E310, Q4, Q430.

## 1. Introduction

Nigeria is richly blessed with natural resources of which crude oil products play a key role. At present, Nigeria is the ninth world producer and sixth world exporter of crude oil (Ehinomen and Adeleke, 2012). On the domestic economy, the petroleum sector generates over 90% of the country's foreign exchange earnings, and provides employment in various forms to Nigerians (Central Bank of Nigeria, 2010). In addition, the tremendous growth in oil earnings has influenced significantly Nigeria's international relations, and sometimes the politics of oil has taken centre stage in the nation's history of international relations in the last few decades (NNPC, 1991).

Petroleum products are derived from crude oil and they include petrol, diesel, kerosene, natural gas, bitumen etc. Oil was discovered in Nigeria in 1956 at Oloibiri in the present Bayelsa State, after a century of searching (Dharam, 1991).Oil products are basically used in industries for

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production of goods and services and they are also used domestically for personal consumption in which the greater percentage of it comes from developed countries.

However, the persistent instability of crude oil prices in the global market has been revealed to have adversely affected macroeconomic performance of the Nigerian economy (Mba-Afolabi, 1999; Labys, 2006; Nwosu, 2009; Arinze, 2011; Runl, 2011; Bobai, 2012) owing to the fact that Nigeria is a monoculture economy which is heavily dependent on crude oil export for its foreign earnings. Crude oil price instability has been found to affect production cost of foreign firms and since Nigeria is import dependent, an increase in crude oil prices makes imported goods to be very expensive which is in turn transmitted to domestic prices by raising the general price level. From 1990 to 2011, the prices of petroleum products were reviewed more than ten times. The adjustment in 2000 under the democratically elected government marked a turning point in the economy as petrol moved up to N30 per litre, diesel to N29 and kerosene to N27 Runl (2011). According to the government, the upward review of domestic prices of petroleum products was necessitated by the high spot market price of crude oil and the need for higher margins for the Nigerian National Petroleum Corporation (NNPC) to meet operational and capital costs.

Petroleum prices in the domestic market have been under government control since 1973 when the government took it over from the private oil companies (Iwayemi, 1993). The prices of petroleum products in Nigeria should theoretically be derived from International Crude oil prices since the marginal supply (litres) comes from import, it should therefore reflect import price. In other words, when the marginal unit of consumption is imported, the economic price should be import parity price. However, this has not always been the case for a number of reasons particularly socio-political ones (Iwayemi and Adenikinju, 1996). Their study identified three factors that have influenced government position. First, is the desire to protect the interest of the poor who could be hurt from higher prices? The second is the need to reduce industrial cost as energy products are seen as critical inputs in production processes. The third factor relates to the potential inflationary impact of higher energy prices. Government of both oil producing and consuming countries invariably intervene in the market to influence product price. The extent of such intervention depends on the specific needs of the country and importance of the product in question. It has also been noted that crude oil cost is not the only cost incurred in the supply and distribution of petroleum products as other costs such as refining costs, transportation and distribution costs are involved.

It is evident that export of petroleum earns valuable foreign exchange in Nigeria, and that petroleum is so important to modern living that shortages disrupt essential transactions. Indeed, the occasional petrol shortages experienced by Nigerian towns and villages due to inefficient distribution is as a result of incompetence and corruption on the part of bureaucrats and the business class (Onwioduokitanda and Adenuga, 2000). The links between petroleum and foreign exchange earnings are easily obvious. More importantly, a proper grasp of the relationship between the domestic and the world economy is essential to the identification of these relationships. The monetisation of petro dollars shows how closely related petroleum is to money stock, which in essence has direct bearing on the inflationary pressures in the economy (Sikkam 1999). This annual growth rate of money supply especially in 1974 and 1975 far outstrips those of all the developed industrial countries as well as the developing countries of the world. Even compared with other OPEC countries where the growth rate of the money supply has been

generally high, the recent growth rates of money supply in Nigeria is alarming. The alarming rate of money supply is influenced by the earnings from petroleum (Osagie 1981).

The oil industry is very important to the Nigerian economy. It provides among other things the greatest part of the foreign exchange earnings and total revenue needed for socio-economic and political development of Nigeria. The bulk of Nigerian crude oil is sold unrefined and when refined, the products range from petrol to heavy liquids for road tarring. However, upward adjustments of petroleum products price have resulted in inflation, high cost of living, inequitable distribution of income in Nigeria (Nwosu, 2009). Between 1978 and 2007, the various Nigerian regimes increased fuel prices a total number of 18 times. Most of the increase occurred in the 1990-2007 period when petroleum products prices were adjusted upwards sometimes twice a year. One major problem this has caused was the instability of the prices of goods and services in the country. Whenever there is an increase in prices of oil products, it affects transportation, cost of good and other services (Mba-Afolabi, 1999). The study will attempt to investigate the impact of changes in petroleum products prices on inflation in Nigeria by looking into the role government has played in petroleum products' price determination in the country over time as well as determine how adverse petroleum products price instability impacted inflation in Nigeria.

The essence for this research work is burnt out of the need to empirically investigate the claim of Mba-Afolabi (1999) that each time petroleum products prices goes up in Nigeria, general price level of goods and services increases almost immediately. Although previous studies have actually explored the relationship between crude oil price and inflation, their studies only concentrate on international crude oil price which does not have direct effect on domestic prices. This study is at variance with existing studies, because it attempts to look at domestic price of crude oil which is expected to have direct effect on the general price level domestically. Also, crude oil price is disaggregated in this study into prices of Premium Motor Spirit (PMS), Dual Purpose Kerosene (DPK) and Automotive Gas Oil (AGO). They are considered because they constitute greater percentage of refined crude oil consumed by both the household and industries in Nigeria, unlike Low Pour Fuel Oil (LPFO), High Pour Fuel Oil (HPFO), Special Naphtha, and Waxes which are less consumed. This is the essence of this study.

## 2. Empirical Review

Labys (2006) observes that higher oil prices can lead to higher inflation, lower corporate profits, higher unemployment and reduced national economic growth. Higher price volatility can lead to a reduction in investment, leading in turn to a long term reduction in supply, higher prices, and even reduced macroeconomic activity. Regnier (2007) found that oil and energy price volatility increased following the 1973 oil crisis. This increase has been accompanied by an increase in price volatility for all commodities. In the late 1970s, however, price volatility for most products returned to pre-1973 levels, while oil price volatility continued to increase, while Raymond (2010) which looked at the effect of price changes of petroleum products in the short and long run and the factors responsible for the changes itself also found that petroleum products prices have significant effect on the economy in the long run.

Nwosu (2009) researched into the impact of fuel price on inflation. The study employed the variance Autoregressive analysis to assess the relative contribution of fuel price on inflation.

Available quarterly data series spanning a period of 1995 to 2008 was analysed. Result showed a positive relationship between fuel price and inflation and therefore advocated that the policy of subsidizing fuel price should continue in Nigeria so as to help cushion the economy from the adverse effects of oil-price shock.

Orgunbodede et al (2010) studied petroleum price crisis and the Nigerian public transportation system. The study claimed that incessant petroleum products price hike led to crisis and industrial actions in the country. They used perception scale on a 4-point Likert scale to elicit response from the operators of public passenger transport system using a 4-point Likert scale. The Mean Weight Value (MWV) was compared with the Group Arithmetic Mean (GAM) of each group and the results indicated that price increase significantly increased transport fare and fuel hoarding in Nigeria.

Arinze (2011) focused on the impact of oil price on the Nigerian economy. The study contends that upward adjustments of petroleum products prices have resulted in inflation, high cost of living, and inequitable income distribution in Nigeria between 1978 and 2007. It also found that the various Nigerian regimes increased fuel prices a total of 18 times within this period with most of the increase occurring between 1990 and 2007 where prices were adjusted, twice a year, sometimes. The study revealed that petroleum price increase spur inflation rate to increase also. It therefore recommended diversification of the Nigerian economy to curb macroeconomic instability which may arise from over dependence on crude oil.

Bobai (2012) analysed the relationship between petroleum prices and inflation in Nigeria. It focused on the impact of petroleum product price increase on the Nigerian economy from 1990 to 2011. Employing the empirical econometric analysis approach and using variables like inflation rate and petroleum prices, the results shows that positive relationship exists between PMS, AGO and inflation. It however found PMS to exert higher effect on inflation than AGO, while negative relationship exists between inflation and DPK. The overall effect clearly indicates that increase in petroleum product price contributes significantly to the rate of inflation in Nigeria.

Ehinomeri and Adeleke (2012) shared their views that the distribution of petroleum products in the Nigerian economy is fraught with complex problems resulting sometimes in products outages, inflated price of products and contentions on the pump price of products. Their research examines the various issues regarding the distribution of products and recommends that the downstream activities of the industry be completely deregulated to allow private sector and entrepreneur's full participations in the distribution of the products. Their findings hypothesized that the participation of entrepreneurs will drive effectiveness into the sector. This effectiveness will bring down operations cost as well as the price level for the benefit of all the stake-holders in the country.

Akinleye and Ekpo (2013) examined the macroeconomic implications of oil price shocks on macroeconomic performance in Nigeria. The study employed the vector autoregressive estimation technique and observed that both positive and negative oil price shocks influence real government expenditure only in the long run rather than in the short run. It also found that positive rather than negative oil price shocks have stronger short and long run effects on real

gross domestic product, thereby triggering inflationary pressure and domestic currency depreciation in the process as importation increases. The study posits that crude oil price shocks are capable of impeding economic growth only in the long run while raising general price levels marginally in the short run leading to exchange rate depreciation and high importation.

To our knowledge, there is a dearth of studies on the relationship between petroleum product prices and inflation as most studies in similar area focused on oil price volatility and macroeconomic performance (Labays, 2006; Raymond, 2010; Orgunbodede et al, 2010; Arinze, 2011; Akinleye & Ekpo, 2013). This study will focus on the impact of crude oil prices on inflation in Nigeria leaning on the study of Bobai (2012) by adding other macroeconomic variables like money supply, fiscal deficit, and exchange rate into the model. In the same vein, existing studies (like Arinze, 2011; Bobai, 2012) use fuel price which is just an aspect of petroleum price. This work is at variance with existing works as it attempts to disaggregate petroleum price into PMS, AGO and DPK. This will be our contribution to knowledge.

## 3. Data and Methodology

This empirical investigation focus on the impact of changes in petroleum products prices on inflation in Nigeria over the [4]period 1994-2012.

Based on the above empirical review on the relationship between crude oil prices and macroeconomic performance and following the works of Arinze, 2011; Bobai, 2012; Akinleye and Ekpo, 2013), we specify our empirical model thus:

$$INF = \beta_0 + \beta_1 PMS + \beta_2 AGO + \beta_3 DPK + \beta_4 MS + \beta_5 FD + \beta_6 ER + ECM(-1) \quad \ldots\ldots\ldots\ldots\ldots (1)$$

$$\text{Where } ECM(-1) = INF - \beta_0 - \beta_1 PMS - \beta_2 AGO - \beta_3 DPK - \beta_4 MS - \beta_5 FD - \beta_6 ER \quad \ldots\ldots\ldots (2)$$

On estimation, the intercept ($\beta_0$) and slope coefficients ($\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, $\beta_5$ and $\beta_6$) are expected, a priori, to have positive sign, $\beta i$ ($i = 0, 1, 2, 3,4,5,6) > 0$, implying that inflation rate are expected to correlate positively with the increase in the prices of petrol, diesel, kerosene, money supply, fiscal deficit and exchange rate. While ECM is the error correction mechanism at lag one.

Data for the study will be extracted from the World Development Indicator, CBN Statistical Bulletin and the Nigerian Oil & Gas Downstream Industry Report. The study will be analyzed by the error correction (ECM) techniques with variables such as AGO, PMS, DPK, MS, FD and ER.

### 3.1 Methodology

The empirical analysis process is anchored on the regression model of the perceived functional relationship between inflation rate (INF) and petroleum products (PMS, AGO and DPK). Numerical values of the model parameters are carried out using the ordinary least squares (OLS) techniques.

[4] Selected based on data availability

**3.2 Long run analysis**

This empirical investigation probes the impact of change in petroleum products prices on inflation in Nigeria over the period 1994-2012. The time series properties of the variables incorporated in our model (model specification) is examined using the Augmented Dickey-Fuller unit root test in order to determine the long-run convergence of each series to its true mean. The test involves the estimation of equations with drift and trends as proposed Dickey and Fuller (1988). The test equations are expressed as:

$$\Delta Z_t = \eta_0 + \eta_1 Z_{t-1} + \sum_{n=1}^{n} \pi_i \Delta Z_{t-i} + V_T \ldots\ldots\ldots\

An equivalent but computationally convenient form is given by:

$$\rho = 1 - \left[\frac{\sum_{n=1}^{n}(R(X_i)(RYi)}{n(n^2-1)}\right] \quad \text{.....(7)}$$

Nijsse (1988) contains the justification and use of t-test application to the Spearman Rho (p). According, the t-test is defined as:

$$t = \frac{\rho}{\frac{1-\rho^2}{n-2}^{\frac{1}{2}}} \quad \text{……(8)}$$

The t-test represented by Equation (3) is based on n-2 degrees of freedom. As Conover (1980) notes, the Spearman's rho (p) is insensitive to some types of dependence in the data; thus, a researcher is allowed to be specific as to the nature of the dependence that may be detected. Under this test, the null hypothesis is that variables Xi and Yi are mutually independent. In other words, there is no monotonic relation between the two variables. The alternative hypothesis is that there is a tendency for the smaller values of X to be paired with the larger values of Y, and vice versa. The null hypothesis is rejected if the calculated *t* falls outside the acceptance region based on the level of significance chosen.

## 4. Empirical Analysis

### 4.1 Descriptive and Correlation Analysis

The price of PMS remained stable until the entry of the military into the administration of the country when the then military government of Yakubu Gowon in 1973 increased the price of PMS from six kobo to eight point forty five kobo (table 4.1), a significant increase of 40.83% and no meaningful reason was given for the increase. Since then, the price had been reviewed upwards several times for various reasons. The major reason was to attract investors into the sector with the aim of constructing more private refineries. Government also embarked on subsidy removal to use the proceeds to improve infrastructure, provide welfare facilities for the people and reduce poverty.

**Table 4.1**Regime of premium motor spirit (PMS) price increase in Nigeria

| YEAR | PRESIDENT | JUSTIFICATION BY GOVERNMENT | OLD PRICE | NEW PRICE |
|---|---|---|---|---|
| 1973 | Yakubu Gowon | | 6.00k | 8.45k |
| 1976 | Murtala Mohammed | | 8.45k | 9.00k |
| 1978 (OCT1) | Olusegun Obasanjo | | 9.00k | 15.37k |
| 1982 (APRIL 20) | Shehu Shagari | | 15.30k | 20.0k |
| 1986 (MARCH 31) | Ibrahim Babangida | Devaluation of the Naira | 20.00k | 39.50k |
| 1988 (APRIL 10) | Ibrahim Babangida | Subsidy is a burden to government's purse | 39.50k | 42.00k |
| 1989 (DEC 19) | Ibrahim Babangida | | 42.00k | 60.0k |
| 1991 (MARCH 6) | Ibrahim Babangida | | 60.00k | 70.0k |
| 1993 Nov,8 | Ernest Shonekan | Subsidy is primary budgetary burdens | 70.00k | N5,0 |
| 1993 (NOV 22) | Sani Abacha | To gain public support | N5.0 | N3.25 |
| 1994 (OCT 2) | Sani Abacha | | N3.5 | N15.0 |

| | | | | |
|---|---|---|---|---|
| 1994 (OCT 4) | Sani Abacha | Response to labour and public resistance | N15.0 | N11.0 |
| 1998 (DEC 20) | Abdulsalami Abubakar | | N11.0 | N25.0 |
| 1999 (JAN 6) | Abdulsalami Abubakar | Response to labour and public resistance | N25.0 | N20.0 |
| 2000 (JUNE 1) | Olusegun Obasanjo | To eliminate waste | N20.0 | N30.0 |
| 2000 (JUNE 8) | Olusegun Obasanjo | Respond to labour and public resistance | N30.0 | N22.0 |
| 2002 (JAN 1) | Olusegun Obasanjo | Free government funds | N22.0 | N26.0 |
| 2003 (JUNE 6) | Olusegun Obasanjo | Encourage foreign and local investment in upstream sector | N26.0 | N40.0 |
| 2003 (OCT 1) | Olusegun Obasanjo | Respond to labour and public resistance | N40.0 | N34.0 |
| 2004 (MAY 29) | Olusegun Obasanjo | | N34.0 | N50.0 |
| 2005 (AUG) | Olusegun Obasanjo | | N50.0 | N65.0 |
| 2007 (MAY 27) | Olusegun Obasanjo | | N65.0 | N75.0 |
| 2007 | Umoru Musa Yar'adua | Compassion for Nigerians | N75.0 | N65.0 |
| 2012 JAN 1 | Goodluck Jonathan | | N65.0 | N141.0 |
| 2012 FEB | Goodluck Jonathan | Respond to labour and public resistance | N141.0 | N97.0 |

***Source: Computed from Various Sources***

We present in table 4.2 the correlation co-efficient between the old and new prices of PMS in Nigeria. The result revealed that the spearman's Rho value is 0.952 implying that there exists a strong positive relationship between the old and the new prices of PMS across different regimes in Nigeria. Also, the two tailed t-statistics test revealed that probability value (p-value) is 0.000 and this indicates significance at 1% level. Therefore, the analysis of correlation between various regimes of petroleum products price change revealed that a significant positive relationship exists.

**Table 4.2 Correlations between various regime of petroleum products price change**

| | | | old price of pms | new price of pms |
|---|---|---|---|---|
| Spearman's rho | old price of pms | Correlation Coefficient | 1.000 | .952** |
| | | Sig. (2-tailed) | . | .000 |
| | | N | 25 | 25 |
| | new price of pms | Correlation Coefficient | .952** | 1.000 |
| | | Sig. (2-tailed) | .000 | . |
| | | N | 25 | 25 |

**. Correlation is significant at the 0.01 level (2-tailed).

The time series data employed for the estimation of the empirical model specified to capture the impact of change in petroleum products prices on inflation in the Nigerian economy are presented in table 4.3 As shown in the table, inflation, price of petrol, price of diesel, price of kerosene, money supply, fiscal deficit and exchange rate are represented as (INF), (PMS), (DPK), (AGO), (MS), (FD) and (ER) respectively.

**Table 4.3:** Data of Prices of Petroleum Products and Inflation

| Year | INF (%) | PMS (₦) | DPK (₦) | AGO (₦) | MS (₦'Million) | FD (₦'Million) | ER ($1=₦) |
|---|---|---|---|---|---|---|---|
| 1994:QA | 61.62198 | 11 | 6 | 9 | 247403 | -23.9506 | 21.8861 |
| 1995:QA | 61.4712 | 11 | 6 | 9 | 310548.1 | 822.4499 | 21.8861 |
| 1996:QA | 20.2159 | 11 | 6 | 9 | 370243.1 | 2437.097 | 21.8861 |
| 1997:QA | 8.28821 | 13.619 | 9.201 | 11.91 | 440729.8 | 394.7392 | 21.8861 |
| 1998:QA | 7.26312 | 23.666 | 20.834 | 22.75 | 535409.2 | 2079.063 | 42.49101 |
| 1999:QA | 6.60896 | 28.512 | 24.93 | 27.512 | 713385.9 | -144.007 | 101.38 |
| 2000:QA | 10.43851 | 21.328 | 16.16 | 20.328 | 1013157 | -27.1052 | 105.7587 |
| 2001:QA | 18.13194 | 23.164 | 19.037 | 22.455 | 1371017 | 105.5319 | 115.3965 |
| 2002:QA | 12.71942 | 30.701 | 28.953 | 30.203 | 1655906 | 9.80665 | 124.1689 |
| 2003:QA | 14.41094 | 45.752 | 46.371 | 46.785 | 2042525 | -33.3398 | 131.2668 |
| 2004:QA | 15.91876 | 57.5 | 64.092 | 72.08 | 2294120 | -10.9207 | 133.4546 |
| 2005:QA | 15.33861 | 66.008 | 68.672 | 92.352 | 3017984 | -14.7143 | 131.0162 |
| 2006:QA | 6.7332 | 66.455 | 70.037 | 91.455 | 4282231 | -24.3921 | 127.5378 |
| 2007:QA | 6.9231 | 70.42 | 77.625 | 98.33 | 6077392 | -1.82898 | 123.4819 |
| 2008:QA | 12.3325 | 75.529 | 80.551 | 107.295 | 8658438 | 419.8335 | 126.784 |
| 2009:QA | 13.0416 | 90.596 | 86.343 | 110.42 | 10001491 | 1292.042 | 151.8562 |
| 2010:QA | 13.0569 | 91.328 | 123.518 | 111.455 | 11502369 | -104.89 | 151.4523 |
| 2011:QA | 11.0347 | 97.672 | 134.086 | 115.42 | 12769408 | -3.84424 | 155.2195 |
| 2012:QA | 12.3092 | 97 | 140.84 | 115 | 14040113 | -17.5073 | 157.805 |

***Source: CBN Statistical Bulletin vol. 23, 2013; WDI, 2014; and Nigerian Oil & Gas Downstream Industry Report, 2008.***

Shown in table 4.4 is the summary statistic on average prices of petroleum products and inflation. The result indicates that average prices of petroleum products i.e. price of petrol (PMS), price of diesel (DPK), and price of kerosene (AGO), stood at 47.37, 51.53 and 57 Naira respectively, and inflation rate is 18.1%. This implies that the prices of petroleum products grow at an average price of 47.37, 51.53 and 57 Naira correspondingly while inflation rate revolves at 18.1% annually between 1994 and 2012. Also, the average value of money supply (MS), fiscal deficit (FD) and exchange rate (ER) stood at 4 011 550, 377.00 and 100.83% respectively.

**Table 4.4: Summary Statistics**

| | INF | PMS | DPK | AGO | MS | FD | ER |
|---|---|---|---|---|---|---|---|
| Mean | 18.14053 | 47.36842 | 51.52632 | 57.00000 | 4011550. | 376.9959 | 100.8294 |
| Median | 12.46154 | 41.31050 | 38.37900 | 37.96500 | 1980665. | -2.833335 | 122.8034 |
| Maximum | 80.68130 | 98.32800 | 141.6600 | 115.8300 | 14181390 | 3771.011 | 158.1033 |
| Minimum | 4.264400 | 9.506000 | 4.174000 | 7.340000 | 220532.0 | -760.2296 | 10.13210 |
| Std. Dev. | 17.45352 | 31.22171 | 42.82294 | 42.42993 | 4461834. | 981.5078 | 50.34083 |
| Skewness | 2.289660 | 0.288347 | 0.673938 | 0.195478 | 1.043865 | 2.075441 | -0.752975 |
| Kurtosis | 7.224228 | 1.583962 | 2.299448 | 1.284625 | 2.592253 | 6.496906 | 1.966295 |
| Jarque-Bera | 122.9119 | 7.402844 | 7.307221 | 9.801964 | 14.32878 | 93.28424 | 10.56536 |
| Probability | 0.000000 | 0.024688 | 0.025897 | 0.007439 | 0.000774 | 0.000000 | 0.005079 |
| Sum | 1378.680 | 3600.000 | 3916.000 | 4332.000 | 3.05E+08 | 28651.69 | 7663.035 |
| Sum Sq. Dev. | 22846.89 | 73109.63 | 137535.3 | 135022.4 | 1.49E+15 | 72251822 | 190064.9 |
| Obs. | 76 | 76 | 76 | 76 | 76 | 76 | 76 |

**Source:** Authors' Computation.

The result in table 4.1 further revealed that the standard deviation of prices of petroleum products i.e. price of petrol (PMS), price of diesel (DPK), and price of kerosene (AGO) stood at 31.22, 42.82 and 42.43 Naira correspondingly and inflation rate is 17.5%. It means that annual deviation of annual money supply (MS), fiscal deficit (FD) and exchange rate (ER) from its long-mean is 4461834.0, 981.51 and 50.34 every year.

**Figure 4.1: Trend of Inflation Rate and Growth Pattern**

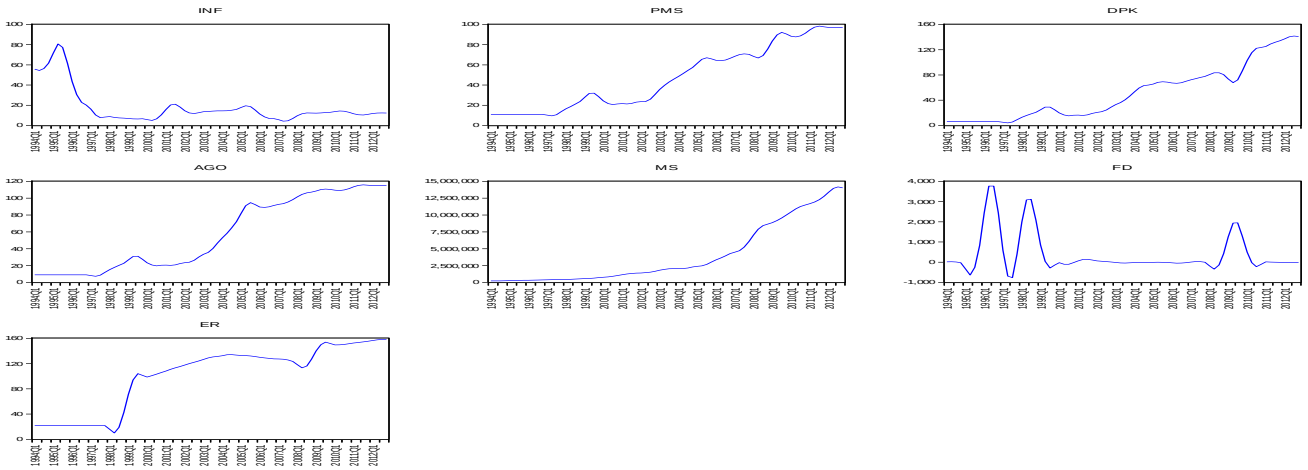

Figure 4.1 shows the time series plot of inflation (INF), price of petrol (PMS), price of diesel (DPK), price of kerosene (AGO), money supply (MS), fiscal deficit (FD) and exchange rate (ER). It is clear from the figure that the trend of inflation rate showed a cyclical growth pattern for about three decades after independence. This indicates that inflation rate in Nigeria has not been consistent and also there is a varying rate of growth. It also shows that the rate of inflation in Nigeria during the post-2009 crisis declines rapidly, while the prices of petroleum products were not impressive during the periods in Nigeria.

### 4.2 Empirical Result

#### 4.2.1 Unit Root Test

The unit root test result as presented in table 4.5 indicates that the time series variable, price of petrol (PMS), price of diesel (DPK), price of kerosene (AGO), money supply (MS), and fiscal deficit (FD) were found not to reject the null hypothesis "*no stationary*" at level, whereas inflation (INF) and exchange rate (ER) were found to be stationary at levels [I(0)]. But after several iterations based on the number of lag length and differencing, the series were found to reject the null hypothesis at first difference.

This indicates that the first-difference of those series is *mean reverting* and stationary. This means that price of petrol (PMS), price of diesel (DPK), price of kerosene (AGO), money supply (MS), and fiscal deficit (FD) are integrated of order one [I(1)]. Thus, this argument prompts the cointegration test to examine if the linear combination of our considered macroeconomic variables yields stationary residual.

**Table 4.5: ADF Unit Root Test Results**

| Variables | ADF Stat at level | Critical Value | ADF Stat at first diff. | Critical Value | Remarks |
|---|---|---|---|---|---|
| **PMS** | -0.3951 | 1%: -3.5271 | -2.6206 | 1%: -3.5271 | Integrated of order 1 |
| | | 5%: -2.9036 | | 5%: -2.9036 | |
| | | 10%: -2.5892 | | 10%: -2.5892 | |
| **DPK** | -0.8601 | 1%: -3.5256 | -3.8221 | 1%: -3.5256 | Integrated of order 1 |
| | | 5%: -2.9036 | | 5%: -2.9030 | |
| | | 10%: -2.5892 | | 10%: -2.5890 | |
| **AGO** | -0.5191 | 1%: -3.5256 | -3.0898 | 1%: -3.5256 | Integrated of order 1 |
| | | 5%: -2.9030 | | 5%: -2.9030 | |
| | | 10%: -2.5889 | | 10%: -2.5889 | |
| **MS** | -0.7982 | 1%: -3.5271 | -5.4843 | 1%: -4.0946 | Integrated of order 1 |
| | | 5%: -2.9036 | | 5%: -3.4753 | |
| | | 10%: -2.5892 | | 10%: -3.1651 | |
| **FD** | -3.4705 | 1%: -4.0906 | -6.8893 | 1%: -4.0966 | Integrated |

| | | | | | |
|---|---|---|---|---|---|
| | | 5%: -3.4735 | | 5%: -3.4763 | of order 1 |
| | | 10%: -3.1640 | | 10%: -3.1656 | |
| **INF** | -3.6573 | 1%: -4.0906 | -5.9643 | 1%: -4.0925 | Integrated |
| | | 5%: -3.4735 | | 5%: -3.4744 | of order 1 |
| | | 10%: -3.1697 | | 10%: -3.1645 | |

Note: * significant at 1%; ** significant at 5%; *** significant at 10% Mackinnon critical values and are shown in parenthesis. The lagged numbers shown in brackets are selected using the minimum Schwarz and Akaike Information criteria.

### 4.2.2 Cointegration and Long-Run Estimates

The long-run relationship between prices of petroleum products and inflation in Nigeria between 1970 and 2012 was examined using the Engle-Granger co-integration technique and the test results are shown on Table 4.6. The result shows that the estimated residual (i.e. ECT) from the empirical model was found to be stationary at level. This indicates that the null hypothesis "no cointegration" was rejected at 5% significance level. This implies that there exist long-run relationships among the variables considered i.e. inflation (INF), price of petrol (PMS), price of diesel (DPK), price of kerosene (AGO), money supply (MS), fiscal deficit (FD) and exchange rate (ER) in Nigeria between 1994 and 2012. Thus, there is long-run relationship among prices of petroleum products and inflation rate in Nigeria.

**Table 4.6: Engle-Granger Co-integration Results**

| Series | ADF Test at Level | | Decision |
|---|---|---|---|
| | Intercept | Critical Value | |
| $ECT = u = INF - \begin{pmatrix} b_0 + b_1 PMS_t + b_2 DPK_t \\ + b_3 AGO_t + b_4 MS_t + b_5 ER_t \end{pmatrix}$ | -3.6914* | -3.4763 | Stationary i.e. Cointegrated |

Note: * significant at 5%. The lagged numbers shown in brackets are selected using the minimum Schwarz and Akaike Information criteria.

**Table 4.7: Long Run Estimates**
**Dependent Variable: INF**

| **Method:Least Squares** | **Sample:1994Q1 2012Q4** | | **Included observations:76** | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Stat** | **Prob.** |
| **C** | 25.14859 | 44.39295 | 0.566500 | 0.5729 |
| **LOG(PMS)** | 70.27523 | 32.42899 | 2.167050 | 0.0337 |
| **LOG(DPK)** | 31.59896 | 12.72636 | 2.482955 | 0.1155 |
| **LOG(AGO)** | 23.86866 | 19.07973 | 1.250996 | 0.2152 |
| **LOG(MS)** | 0.954748 | 0.394073 | 2.422772 | 0.0244 |
| **FD** | 0.601523 | 0.276367 | 2.176534 | 0.0022 |
| **ER** | 0.231844 | 0.098881 | 2.344475 | 0.0132 |
| **R-squared** | | | 0.734 | |
| **Adjusted R-squared** | | | 0.685 | |
| **S.E. of regression** | | | 13.687 | |
| **F-statistic** | | | 28.825 | |
| **Prob(F-statistic)** | | | 0.000 | |
| **Durbin-Watson stat** | | | 1.884 | |

***Source: Computed from Eviews***

The ordinary least square result presented in Table 4.7 above shows the estimates of the long-run model that captures the effect of prices of petroleum products on inflation rates in Nigeria between 1994 and 2012. The result shows that all the variables have positive relationship with inflation in Nigeria, which confirms our apriori expectation. However, only price of prime motor spirit (PMS), money supply (MS), fiscal deficit (FD) and exchange rate (ER) significantly impact inflation in the country. Positive and significant effect of PMS could be the resulting effect of high demand for PMS in term of transportation and household use in the country. Thus, any increase in the pump price of PMS reflects almost immediately on the prices of household goods in the country. In terms of magnitude, a naira increase in the price of PMS and money supply will increase inflation rate in Nigeria by 70.28%, and 96% respectively. Also, other indicators like price of diesel (DPK), price of kerosene (AGO) exert positive but not significant impact on inflation in Nigeria.

The F-statistic result showed that all the incorporated independent variables are simultaneously significant at 1% critical level. The R-squared value of 0.734 suggests that over 73% variation in inflation rate in Nigeria is explained by the explanatory variables in the model. Also, the adjusted R-squared result reveals that the model is a good fit since about 68.5% of the total variation in inflation rate (INF) is accounted for by price of petrol (PMS), price of diesel (DPK), price of kerosene (AGO), money supply (MS), fiscal deficit (FD) and exchange rate (ER) after removing the effect of insignificant estimators from the model. The Durbin- Watson test result reveals that there is no serial correlation among the residuals, because of the d-value (1.885). Thus, we reject the null hypothesis of existence of serial auto correlation among the residuals.

**Table 4.8: Estimated ECM Model**

**Dependent Variable: INFlation**

| Variable | Coefficient | Std. Error | t-Stat | Prob. |
|---|---|---|---|---|
| **C** | -0.140882 | 0.611312 | -0.230458 | 0.8185 |
| **D(LOG(PMS))** | 18.739157 | 9.95340 | 1.882689 | 0.0647 |
| **D(LOG(DPK))** | -15.83109 | 7.648163 | -2.069920 | 0.0428 |
| **D(LOG(AGO))** | 18.86153 | 17.28132 | 1.091440 | 0.2795 |
| **D(LOG(MS))** | 22.08410 | 11.57777 | 1.907457 | 0.0613 |
| **D(FD)** | -0.003999 | 0.000768 | -5.206923 | 0.0000 |
| **D(ER)** | -0.299123 | 0.098519 | -3.036195 | 0.0036 |
| **D(INF(-1))** | 0.880009 | 0.068960 | 12.76122 | 0.0000 |
| **D(LOG(PMS(-1)))** | 17.638772 | 8.97383 | 1.965579 | 0.0541 |
| **D(LOG(DPK(-1)))** | 14.74808 | 7.510306 | 1.963712 | 0.0543 |
| **D(LOG(AGO(-1)))** | 15.71464 | 17.25322 | 0.910824 | 0.3661 |
| **D(LOG(MS(-1)))** | 21.29157 | 11.61885 | 1.832502 | 0.0719 |
| **D(FD(-1))** | 0.003999 | 0.000830 | 4.817506 | 0.0000 |
| **D(ER(-1))** | 0.296078 | 0.099659 | 2.970909 | 0.0043 |
| **ECM(-1)** | -0.577415 | 0.021668 | -3.572727 | 0.0007 |
| **R-squared** | | | 0.793946 | |
| **Adjusted R-squared** | | | 0.745052 | |
| **S.E. of regression** | | | 2.078204 | |
| **F-statistic** | | | 16.23806 | |
| **Prob(F-statistic)** | | | 0.000000 | |
| **Durbin-Watson stat** | | | 1.620199 | |

***Source: Computed from Eviews***

The short-run analysis of the relationship between prices of petroleum products and inflation rate in Nigeria between 1994Q1 and 2012Q4 was examined using error correction mechanism (ECM) model and the estimated results were shown on Table 4.7. From Table 4.8 there is clear evidence of changes in variable determinants effect in the short-run compared to the long-run estimates presented on Table 4.7 but, there are variations in terms of signs for parameter estimates of prices of petroleum products, denoting that they have effect on inflate rate in the short-run, though still insignificant. In the short-run analysis, PMS, AGO and money supply were found to positively impact inflation in the current period and previous periods. This implies that increase in the price of PMS, price of AGO and money supply intensifies inflation the more as domestic prices become highly dependent on these three variables. This is understandable owing to the fact that both prices of PMS and AGO directly affect productive activities thereby increasing cost of operations and consequently affecting the general price level across board. A key fact to note in the result also is that money supply, both in the current and previous periods, have greater effect on inflation in Nigeria than the price of PMS. However, price of DPK was found to negatively impact inflation, as an increase in the price of DPK will cause a decrease in inflation in Nigeria. This may be consequent upon the fact that DPK is more consumed by households and has little to do with cost of production and general price level though it is significant in the model at 10%. Exchange rate and fiscal deficit of the current period have negative impact on inflation, but the lagged values impact inflation negatively. This conforms to expectation because fiscal deficit in Nigeria is financed with external loan as so will not have positive effect on inflation as when it is financed with loan from domestic sources. The lagged value of inflation was found to be significant and positively impact current inflation as its value of 0.88 mean that 1% increase in previous inflation will cause current inflation to increase by 88%. The short run

estimates also show that all the explanatory variables, except the price of diesel (AGO), were found insignificant at 0.05 and 0.1 critical regions. The lag of the error correction term (ECT) was found statistically significant at 5% level with the co-efficient of 0.577. This indicates that 57.7% of the distortion in the short-run is corrected in the first year in attainting equilibrium or sustainable inflation rate on the basis of the changes in the prices of petroleum products and other macroeconomic indicators in Nigeria. The R-squared value of 0.7939 shows that the model is a good one because over 79% of variation in inflation rate is explained by the explanatory variables in the model and just 21% by omitted variables.

## 5. Conclusion

This sub-section presents the conclusion to results in regards to the impact of change in petroleum products prices on inflation in Nigeria between 1994 and 2008 that span across the period of Post-Structural Adjustment Programme (SAP) economic eras. It revealed that the prices of petroleum products (especially PMS and AGO) significantly affect inflation in Nigeria. Thus we reject the null hypothesis and accept the alternative hypothesis that rises in petroleum products prices significantly impact inflation in Nigeria. We hereby recommend the following:

a) Removal of subsidy on PMS should not be implemented to prevent hike in the prices of basic house hold commodities in the economy.
b) Local refining of crude oil should be encouraged to boost production and availability of refined petroleum products for domestic use. This can be achieved through the setting of guidelines and standards for operators of illegal refineries to enable them operate legally as destroying the facilities amounts to waste of capital to the operators and the nation. The legal operation of these refineries would stimulate employment and boost immediate local supply capacity of petroleum products.
c) Government should vigorously pursue the revitalization of the railways as an alternative to road transportation. This will reduce the incidence of illegal diversion of fuel through tankers and the demand for fuel for road haulage and mass transportation.
d) Government should deregulate the downstream sector of the petroleum industry to attract investment as no investor that buys crude oil at international market price would be willing to refine and sell its products in a regulated market. The sector must be attractive enough to guarantee fair returns on investment.

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